

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
3 July 2003 (03.07.2003)

PCT

(10) International Publication Number
WO 03/054861 A2(51) International Patent Classification⁷: **G11B**Seoul (KR). KWON, Jin-Man [KR/KR]; 8-102,
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135-270 Seoul (KR).

(21) International Application Number: PCT/KR02/02342

(22) International Filing Date:
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(25) Filing Language: Korean

(26) Publication Language: English

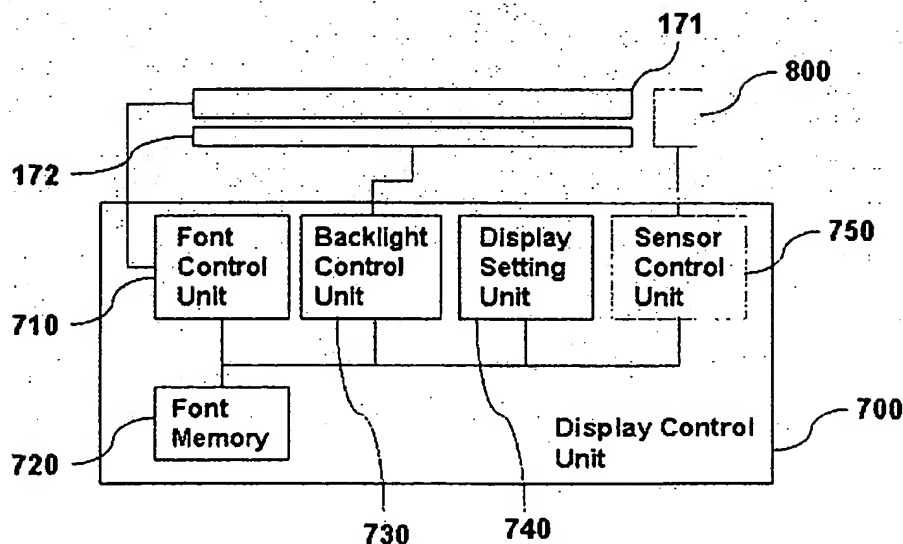
(30) Priority Data:
10-2001-0078360
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[KR/KR]; 3F, 48-10, Bon-dong, Dongjak-gu, 156-060(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK,
LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX,
MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG,
SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC,
VN, YU, ZA, ZM, ZW.(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK,
TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: DIGITAL AUDIO PLAYER ENABLING AUTO-ADAPTATION TO THE ENVIRONMENT



(57) Abstract: Digital audio player that is possible to set up a playing environment in passive mode, or in automatic mode wherein an auto-adaptation is performed to sensing the playing information automatically is provided. It is possible to control the brightness of a backlight in displaying unit or a displayed font size according to the playing environment or to the brightness of the player environment and control ESP mode according to the outside impact. The player is started in high-speed to skip the step of reading a detail information of the recording medium and constructing database. The player sets up an equalizer mode automatically to using the genre information included within a digital audio file and supports multi-languages with menu and displaying language.

WO 03/054861 A2

WO 03/054861 A2**Published:**

— without international search report and to be republished
upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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【DESCRIPTION】**【TITLE OF THE INVENTION】**

Digital audio player enabling auto-adaptation to the environment

【TECHNICAL FILED】

5 The present invention relates to a digital audio player. More specifically, the present invention relates to a multimedia player that is possible to set up playing environments automatically to sense a surrounding environment like a vibration, light and darkness, etc., whether the recording medium is changed or not, and the genre of music.

10 **【BACKGROUND OF THE INVENTION】**

Compact disc players have been widely distributed as a digital audio playing system. A compact disc player can store audio data of about 650 M bytes. A compact disc has capacity to store 72 minutes long digital audio data, if the data has WAV format which has a sample format of 16 bit - 44.1 KHz. Thus, 15 generally, a compact disc can be recorded digital audio data up to a maximum of 20 music files, assuming that each of the music files has playing time of about 4 minutes. The conventional compact disc playing system has a displaying unit to display the information of music being played or shows serial numbers of the recorded digital audio data of which the user can listen to the desired music by 20 choosing the serial number of the audio data that he or she wants to listen to.

But, it is difficult to recording numerous amounts of audio data in the recording medium having limited capacity because above WAV format digital audio data is occupied to high capacity of roughly 10 Mbytes per 1 minute. Particularly, it is difficult to transfer audio data by using communication.

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Solving the above problem, it is developed to the digital audio data formats which are more compressed than the digital audio data of WAV format.

Representative formats are MPEG2 Layer 3 format, i. e., MP3 format, Windows Media Audio (WMA), Real Audio (RA), etc., and the systems are developed to playing thereof. These formats can compress digital audio data of WAV format to one tenth of the original data, but the quality of the original sound is completely preserved. If the digital audio data of the above compressed format is recorded in a compact disc, analog audio data of about 850 minutes can be recorded. That is, 200 pieces of music can be recorded assuming that each of music is played for about four minutes. And the amounts of recordable audio data are increasing to use high capacity recording medium like a hard disk.

It is required that the playback system, which plays the recording medium (compact disc as an example) stored digital audio data files compressed above format, has more function and characteristic which is different from the conventional playback system because one recording medium stored above compressed format can be stored more than the conventional format.

It is improper to use conventional method to display or play in playing music for conventional compact disc playing system when 200 pieces of music is recorded to a compact disc. Accordingly, it is developed and used to the displaying method in digital audio playing system that retrieves and plays the large quantity of audio data recorded in MP3 format easily and speedily.

That is, generally, conventional compact disc player displays only music number through LED display equipment, and allows only the retrieval and select-playing using music number. But the compressed format digital audio

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playing system uses a large display window comprised LCD, displays the music information (title of music, artists, etc.) being played through the large display window, and selects music files stored to various formats.

In the playing system of a compact disc stored to the compressed format
5 audio data files, it is an important factor for the size of displaying unit or displaying type, because various and numerous information is displayed through the displaying unit. Especially, playback system used memory or compact disc to a recording medium is widely used for handheld and vehicles, because it is small and light. So it is desirable to change the displaying format in suitable to
10 the environment for the convenience using at night or in dark place.

Moreover, there is high probability for the player for handheld or vehicles to take an impact from the exteriors compared with the player for fixing. The states of cutting off or breaking a playing sound are occurred in case of being taken serious impact to the player from the exteriors. More specially, it is
15 possible that the compressed format digital audio data player takes the effect of the exterior impact more than general player because the information volume stored to the compressed format is large in the same physical section of recording medium.

To solve above problem, it is provided for the portable equipment to
20 have general ESP (Electronic Stability Program) function. The ESP function is provided to the mode that prepares for the case of not reading the recording medium caused by impact by loading some data which is hereafter part of playing in advance. But it is unfavorable to the point of resource utilization that the function of ESP is used in the case of few occurring of exterior impacts,

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because most of available memory is utilized to a protection of impacts as maximum using of ESP function.

Besides, digital audio data player reads information of compact disc and then stores to a memory to get the information of the music stored in recording medium (compact disc as an example) when the compact disc is loaded to the player. More specially, the method for using to be database for additional information related to audio data or location of audio data recording medium previously, in case of the compact disc stored digital audio data of compressed formats that numerous information are stored.

10 The built-up database related to a stored music to read the information stored in a compact disc like above, is an advantage in view of the convenience for retrieval of music, but it is a disadvantage in view of the requirement for operation and time every to load compact disc for building up database. More specially, it is a waste of time and resources in a point that a step of constructing
15 database is over again in spite of not constructing the overlapping database when the same compact disc is played repeatedly.

【SUMMARY OF THE INVENTION】

Present invention is invented to solve above problems. It is first object to provide a digital audio player and method thereof that it is possible for user to
20 read and select information from recording medium with ease regardless of changing surrounding environments like a shade.

It is second object to fully operate the function of protect-impact used self-resource of the player more effectively.

It is third object to provide a digital audio player and method thereof that

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it is possible to retrieve and play the digital audio data stored to a recording medium, like a compact disc for example, in high-speed.

It is fourth object to provide a digital audio player and method thereof that may use various additional functions used the player in automatic without
5 user's special handling.

For achieving above objects, it is possible to control brightness of backlight or size of display fonts in displaying unit by passive mode or automatic mode according to the brightness of playing environments; control ESP mode according to an extent of exterior impacts, and high-speed operation without a
10 step of reading detail information from recording medium; and build up database to check in advance whether the recording medium is changed or not when a power source is changed the status being off.

That is, a digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a decoding
15 unit for generating digital audio signals to decode digital information signals extracted from the recorded information; a digital analog converter for providing an output device of audio signal converting digital audio signals to analog signals; an input unit for inputting a predetermined command from a user; a displaying unit for displaying information regarded to the recording medium,
20 digital audio data, or additional information; a memory for storing the information regarded to the recording medium, digital audio data, additional information, or temporary-generated information related thereof; and a control unit for controlling each units, wherein the control unit comprises a display control unit for changing a display format of the displaying unit according to

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surrounding environments of the digital audio player.

The Digital audio player further comprises a font memory stored at least one more font data displayed through the displaying unit, and wherein the display control unit comprises a font control unit for controlling the font
5 displayed through the displaying unit using the font data stored the font memory. And digital audio player wherein the displaying unit comprises backlight, and the display control unit comprises a backlight control unit for controlling the backlight.

The digital audio player further comprises a shading sensor for sensing
10 the exterior shade of the player, wherein the display control unit comprises a sensor control unit for controlling the shading sensor, and controls the displaying unit to select a proper display format according to the exterior shade of the player sensed by the shading sensor, and display information.

The display controls unit comprises at least two display modes, and
15 may control the displaying unit to display information according to a display mode selected by user among the display modes.

Digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a reading unit for reading the recorded information from the recording medium; a digital
20 signal processing unit for extracting digital information from recording information read by the reading unit, and processing in proper; a decoding unit for generating digital audio signal to decode digital information signal; a digital analog converter for providing an output device of audio signal converting digital audio signals to analog signals; a driving unit for driving the recording

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medium or reading mean synchronized with the reading operation of the recording medium to vary a reading location in the recording medium; an input unit for inputting a predetermined command from an user; a displaying unit for displaying information regarded to the recording medium, digital audio data, or additional information; a memory for recording the information regarded to the recording medium, digital audio data, additional information, or temporary generating information related thereof; and a control unit for controlling the each units, wherein the control unit reading the digital audio data recorded to the recording medium and recording to the memory, playing the digital audio data to use the digital audio data recorded in the memory, controls the reading unit to initiate the operation of reading when the amount of the digital audio data recorded in the memory is under the standard value of a predetermined reading initiation, and may change the standard value for initiation of reading according to surrounding environments of the digital audio player.

And digital audio player further comprises a vibration sensor for sensing the vibration inflicted to the player, wherein control unit may control the vibration sensor, and changes the standard value for initiation of reading according to the extent of vibration inflicted to the player which is sensed by the vibration sensor.

Besides, the digital audio player, wherein the control unit comprises at least two vibration modes and the standard value for initiation of reading corresponding the vibration modes, and changes the standard value for initiation of reading according to the vibration mode determined by the

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selection of user among the vibration modes. The Digital audio player, wherein the control unit reads digital audio data recorded to the recording medium from the recording medium, checks errors in the digital audio data before recording to the memory, determines the extent of impact inflicted to the
5 player by checking whether the detected error is corruption of digital audio data due to impact, and changes the standard value for initiation of reading according to the extent of impact inflicted to the player.

The digital audio player, which plays digital audio data to read from a recording medium recorded plurality of digital audio files, wherein comprises
10 a memory for storing database being build to extract information related to the plurality of digital audio files with the view of readily retrieval of the plurality of digital audio files; and a control unit for controlling the player to retrieve and playing the digital audio files using the database stored the memory, wherein the memory is nonvolatile memory that stored contents are keeping despite a
15 power source is off, and the control unit checks the recording medium loaded to the player whether it is same to the previous played recording medium or not, and operates retrieving and playing operation using database stored the memory without the building operation of the database when the checking result is same to the previous recording medium.

20 The control unit may check, whether the recording medium is same to the previous recording medium or not, by mechanical method of using a sensor or switch. And the control unit may check, whether the recording medium is same to the previous recording medium or not, by comparing the information stored in the memory with reading basic information area of the recording

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medium loaded to the player.

The control unit performs the step of (a) checking, whether the recording medium is same to the previous recording medium or not, by using mechanical method of using a sensor or switch; (b) checking, whether the recording medium is same to the previous recording medium or not, by comparing the information stored in the memory with reading basic information area of the recording medium loaded to the player when the checking result of (a) step is different to the previous recording medium; (c) operating a retrieving and playing operation using database stored the memory when the checking result of step (a) or step (b) is same to the previous recording medium; and (d) controlling the player to retrieving and playing the digital audio files using the database stored the memory, after storing to the memory by extracting the information related to the plurality of digital audio files recorded to the recording medium and building database, when the checking result of step (b) is different to the previous recording medium.

The digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a decoding unit for generating digital audio signals to decode digital information signals extracted from the recorded information; a digital analog converter for providing an output device of audio signal converted digital audio signals to analog signals; an input unit for inputting a predetermined command from a user; a displaying unit for displaying an information regarded to the recording medium, digital audio data, or additional information; a memory for storing the information regarded to the recording medium, digital audio data,

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additional information, or temporary generating information related thereof;
and a control unit for controlling the each units, wherein the output device of
audio signal comprises an equalizer for correcting a distortion appeared in
amplification or transferring of signal, and the control unit controls the output
5 device of audio signal to output the audio signal in equalizer mode
corresponded to that of extracted information related to equalizer of digital
audio data included the digital audio files. And the equalizer related
information comprises information of genres or sounds. And the equalizer
related information may be extracted from file name of the digital audio files.
10 The equalizer related information may be extracted from ID3 tag of the digital
audio files when the digital audio files are MP3 format files.

The digital audio player, which plays digital audio data to read from a
recording medium recorded digital audio files, wherein comprises a decoding
unit for generating digital audio signals to decode digital information signals
15 extracted from the recorded information; a digital analog converter for
providing an output device of audio signal converting digital audio signals to
analog signals; an input unit for inputting a predetermined command from a
user; a displaying unit for displaying an information regarded to the recording
medium, digital audio data, or additional information; a memory for recording
20 the information regarded to the recording medium, digital audio data,
additional information, or temporary generating information related thereof;
and a control unit for controlling the each units, further comprises a menu
database having menu data consisted of at least two languages, and wherein
the control unit controls the displaying unit to display the information using

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the menu data consisted of the language determined by user's selection among the menu database.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 shows a block diagram of an embodiment for a digital audio data
5 player.

Fig. 2 shows a block diagram of another embodiment for a digital audio
player.

Fig. 3 shows a schematic diagram for the structures of digital audio data
files.

10 Fig. 4 shows a schematic diagram illustrated the state of recording digital
audio data files to a recording medium.

Fig. 5 and Fig. 6 show an embodiment of a picture provided to user
through a displaying unit in the state of playing and retrieving respectively.

Fig. 7 shows a block diagram for components related to a displaying
15 control within the player.

Fig. 8 shows an embodiment of an interface picture provided to user for
displaying control in the player.

Fig. 9a and Fig. 9b shows an embodiment of displaying picture used
common size fonts and large size fonts respectively.

20 Fig. 10 shows a principle operation for ESP function.

Fig. 11 shows a flow chart of a method for setting up ESP mode using
error checking operation operated to read a data from a recording medium.

Fig. 12 shows a flow chart to check whether a recording medium is
changed or not for high-speed operation of a player.

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【BEST MODE FOR CARRYING OUT THE INVENTION】**1. Digital audio data, recording medium and player**

Fig. 1 shows a block diagram of an embodiment for a digital audio data player.

5 The player 100 illustrated in Fig. 1 reads and plays digital audio data to drive a recording medium 101. The digital audio data player 100 applied present invention comprises a reading unit 103 for reading a recording information from the recording medium 101; a digital signal processing unit 105 for extracting digital information from the recording information and processing
10 in proper; a decoding unit 107 for generating digital audio signal to decode digital information signal; a digital analog converter (DAC) 109 for providing an output device of audio signal converting digital audio signals to analog signals; a driving unit 111 for driving the recording medium 101 or reading mean synchronized with the reading operation of the recording medium to vary a
15 reading location in the recording medium 101; an input unit 113 for inputting a predetermined command from an user; a displaying unit 117 for displaying information regarded to the recording medium 101, digital audio data, or additional information; a memory 115 for storing the information regarded to the recording medium 101, digital audio data, additional information, or temporary
20 generating information related thereof; and a control unit 119 for controlling above each units.

The recording medium 101 played through the player of the present invention comprises optical or magnetic disc like a compact disc (CD), magnetic disc (MD), digital versatile disk (DVD), and magneto-optical disc (MO). And

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the medium like a hard disc or diskette may be comprised to the recording medium of present invention, if it is possible to record digital data.

And, a volatile or nonvolatile memory may be used to the recording medium. Using the volatile or nonvolatile memory to the recording medium, 5 the configuration of the digital audio player may be constituted like a Fig. 2 because it is possible to direct control the digital audio data stored a volatile or nonvolatile memory through a control unit without reading the recording information from the recording medium.

That is, the digital audio data player 200 applied present invention 10 comprises a first memory (audio memory) 201 for storing a digital audio data; a decoding unit 207 for generating digital audio signal to decode digital information signal stored to the audio memory 201; a digital analog converter (DAC) 209 for providing an output device of audio signal converting digital audio signals to analog signals; an input unit 213 for inputting a predetermined 15 command from an user; a second memory 215 for recording the information related to the audio memory 201, digital audio data, additional information, or temporary generating information related thereof; and a control unit 219 for controlling above each units.

A unit for recording audio signal continuously played is called to digital 20 audio data file in present specification. That is, if one file is played, it is defined that the digital audio data recorded to a corresponding file is continuously played in case of not being an interrupt signal. Generally a piece of music is recorded to one file in case of digitalizing music. These digital audio files are a format digitalized without data compressing like a PCM format from audio

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signal and digitalized with data compressing like a MP3 or WMA format. The scope of present invention is not limited to the digital audio data composed of MP3 format, but hereafter describing the digital audio data composed of MP3 format for representative embodiment.

5 Fig. 3 shows an embodiment of a structure for one digital audio data file. There are varieties type of digital audio files, and have fixed formation respectively. Fig. 3 shows one embodiment of the digital audio data file and it is composed of file name (FN) field, file attribute (FA) field, file data (FD) field, and additional information tag (FT) field, etc..

10 These digital audio data files are stored to a various recording medium according to the rule of file system which is obedient to the characteristic of recording medium. Fig. 4 shows a schematic diagram illustrated the state of recording digital audio data files stored to a recording medium.

 According to the Fig. 4, the recording medium is allocated to a disc
15 information recording area 401, directory information recording area 403, and data information recording area 405, etc.. The disc information recording area 401 is recorded to specific information of the appropriate recording medium like a name of appropriate recording medium, total recording capacity, and a recording point. The directory information recording area 403 is recorded to a
20 directory name, file information and lower directory information included to the appropriate directory. The data information recording area 405 is recorded to data and tag related to the file information like a file name included to the directory information recording area 403.

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2. Method for displaying information

The digital audio player 100, 200 applied to the present invention may be displayed the various information like digital audio data or additional information using the displaying unit 117, 217. Generally, it is displayed the information related to appropriate music (title of music, artist, and playing time, as an example) in case of playing the specific music, and displayed the directory structure or music list during in case of retrieving for playing music.

Fig. 5 and Fig. 6 show an embodiment of a picture provided to user through a displaying unit in the state of playing and retrieving respectively. Various additional information, which is a title of music being played, artist, redundant capacity of battery, and playing time as an example, are displayed in Fig. 5. The list of digital audio files included within a specific directory is displayed in Fig. 6. But, the displaying method of information is not limited to the above embodiment, and various contents and amounts of information may be displayed as the occasion demand.

The displaying window showed Fig. 5 and Fig. 6 may be comprised to liquid crystal display (LCD) as an example, and it is desirable to be large size for displaying enough amount of information. Moreover, it is desirable to have backlight equipment for displaying and reading information at night or in dark place.

According to the present invention, it is provided to a changing method of information displaying format and playing system thereof according to the surrounding environments. The changing of displaying format may comprise an on-off of backlight, changing the brightness, and changing the display font.

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And above functions are embodied by a control unit and displaying unit of the player. Fig. 7 shows a comprising embodiment of the player in present invention around the control unit and displaying unit. Fig. 7 shows only the components related to display information among the control unit of the player, and the other components for controlling the residue are omitted. The function and operation of the control unit for controlling the others in the player is omitted because it is conventional arts.

As showed in Fig. 7, the player of present invention comprises a part of controlling the information displaying format, that is, display control unit 700 within the control unit. The display control unit 700 comprises a display setting unit 740 for setting up a display format; a font control unit 710 for controlling a display font; and a backlight control unit 730 for controlling a backlight. The font control unit 710 and the backlight control unit 730 are connected to the display setting unit 740 respectively. The font control unit 710 is connected to a font memory 720 stored font data which is various sizes. Fig. 7 shows the composition of the font memory 720 within the display control unit 700, but the font memory may be comprised to the special storing equipment with the exception of the control unit.

On the other hand, the displaying unit of the player comprises a LCD 171 and backlight 172. The LCD 171 and backlight 172 is connected to the font control unit of the display control unit 700 and a backlight control unit 730 respectively. The backlight control unit 730 controls whether the backlight 172 is on or off, time duration of on/off, and the brightness of backlight. The font control unit 710 controls to display the necessary information through LCD 171

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using various fonts stored in the font memory 720.

On the other hand, the player of present invention further comprises a shading sensor 800. It is possible to sense the exterior shade of the player automatically, and uses that as information for setting up a displaying format in case of using the shading sensor 800. The display control unit 700 further comprises a sensor control unit 750 for controlling the shading sensor 800 therefor, and the sensor control unit 750 is connected to a display setting unit 740.

A method of changing information display format is provided to divide three types. First type is select the display format according to the choice of user, second type is select one among the predetermined modes determined in advance, and third type is select display format sensed automatically surrounding environments in the player. Describe above methods in turns.

Most of all, choosing a display format according to the selection of user is a method designated from user for a brightness of backlight and a size of font directly. The brightness of backlight may be selected among the menu like an always tuning off/ always tuning on/ turning on for 3 seconds/ turning on for 5 seconds as an example. The font size may be selected among the menu like an enlarge showing/ normal showing as an example or the value which user wants within a scope provided from the player. Fig. 8 shows an embodiment of an interface for selecting the backlight and font size.

Second method selected one among the predetermined modes determined in advance, is that a displaying format is determined to apply the setting facts for each modes if user select one among the designated mode, night/day/vehicle as an example, in the player. The user may set up the modes

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in advance, that is always tuning on/normal size font of backlight in night mode, always tuning off/minimum size font of backlight in day mode, tuning on for 3 seconds/maximum size font in vehicle mode as an example, and information may be displayed to the format appropriated mode by selecting the desired display mode.

On the other hand, it is possible to set up for changing the displaying format according to time, if a clock is built-in the player. Before a.m. 6 and after p.m. 6 is set up to a night mode, between a.m. 6 and p.m. 6 is set up to a day mode as an example, and it is possible to change the time applied to each modes by user.

Third method, selected display format to sense automatically surrounding environments in the player, is the type that automatically set up the displaying format according to the automatic sensing after sensing surrounding environments using the shading sensor. The player comprises means which is possible to sense surrounding environments with a shading sensor 800 showed in Fig. 7. The shading sensor 800 is desirable to set up in adjacent part of display window in the player. The shading sensor 800 is controlled by a sensor control unit 750, the appropriate displaying format is determined by using the sensing value, and then information is displayed according to thereof.

Fig. 9a and Fig. 9b shows an embodiment of displaying picture used common size fonts and large size fonts respectively. The title of playing music and artist is displayed in case of normal size font (Fig. 9a), and may be displayed to large size in case of using large size font (Fig. 9b).

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3. Automatically protect-impact system.

The multimedia playing system and method of present invention provides an ESP function of various levels and an automatically setting function of ESP.

5 The ESP function is that continuously plays digital audio data by storing a uniform cost of data to previously read in preparation for the impact taken from exterior, as the system to reading and playing data stored to the recording medium that is sensitive to impact like a compact disc or magnetic disc. If the impact from exterior is taken to the player, the operation of reading the recording
10 medium in the player may be out of order. Accordingly, an occasion of breaking a sound may be occurred to interrupt the playing of data due to disorder of reading operation in recording medium when the reading of recording medium is synchronized to the playing of information which is read. To prevent above occasion, uniform cost of data are previously read and stored
15 to memory and then operates the playing operation using that (refer to Fig. 10). Besides, uniform cost of data previously read and stored to memory is played, and then as the amount of the data stored to memory is under the predetermined value A (hereinafter, it is called to "standard value for initiation of reading"), the operation of reading the recording medium and carrying the data to memory is
20 repeated because data reading speed is faster than data playing speed generally.

And the playing characteristics are different to that of a level in standard value for initiation of reading. That is, there is little probability of breaking a sound because the amount of residual data in memory is abundant, but there is much consumption of power because frequency driving for recording medium is

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necessary to read the data, when the standard value for initiation of reading is set up a high level. On the contrary, there is little consumption of power when frequency driving for recording medium is not necessary to read the data, but there is much probability of breaking a sound because the amount of residual data in memory is deficient, when the standard value for initiation of reading is set up a low level.

The amount of data which is stored in maximum is determined according to the capacity of memory comprised in player. It is focused to the ESP function enlarged to the capacity of memory in case of the application in specific using like the player for sports as an example, but the capacity of memory is controlled to consider the cost or maintaining time of battery in case of general player.

But, it is possible to change the operating time of ESP function according to the changing of the standard value for initiation of reading as stated above. That is, the efficiency using gets accomplished by changing the setting up of ESP function, in case of expecting a strength and frequency of impact taken from exterior. The standard value for initiation of reading is set up low level in the mode that expected impact is small, and the value is set up high level in the mode that expected impact is high to read and store a large amount of data to memory in advance.

And the method of setting up ESP function is provided to divide three types. First type is that user selects an impact level or protect-impact time in passive, second type is select one among the predetermined modes determined in advance, and third type is select ESP mode sensed surrounding environments automatically in the player. Describe above methods in turns.

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First type that user selects ESP mode in passive is accomplished through the setting up protect-impact time within the tolerance field at discretion. If it is provided to the buffer function which is protect the breaking of a sound regardless of impact for 480 seconds in maximum in case of playing the digital audio files compressed MP3 format in the player, the user may appoint that how long is the protect-impact time within the extents of 480 seconds allowed to the player. Besides, the user may select the extents of impact and set up the protect-impact time appropriate to that in the player. That is, the user select the extents of impact that is none/normal/much, etc..

10 Second type that user selects one among the predetermined modes determined in advance is that the ESP function mode is determined to apply a setting point about each mode as user selects one among the appointed modes for example stopped state/ driving/ walking. It is possible to use the protect-impact function for energy saving in stopped state, the normal protect-impact
15 function in driving, and maximum protect-impact function in walking.

Third type that selects ESP mode sensed surrounding environments automatically in the player is provided. These methods are divided by two types that one is the method of using the reading algorithm in the player itself and the other is the method of sensing the impact using special equipment like a
20 sensor for sensing impact.

The first type is accomplished to use the error checking operation which is accomplished with reading data from the recording medium, and Fig. 11 shows the flow.

First of all, checks whether an error is existed or not in the data to read a

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- uniform cost from a recording medium in step S1110. The error checking operation is used in conventional player, and the appropriate data is stored to memory in case of being decided that an error is not exist into the read data after reading the data from recording medium. It may be used a variety of error
- 5 checking method.

- The case that data read from recording medium are exist errors is roughly two. First case is that the error is exist the data itself recorded to recording medium. The error may be always detected in same area in first case. Differently in first case, the error is occurred due to an impact of exterior which is
- 10 effect to a reading operation. The error is occurred regardless of data area. Accordingly using the time and area of error is occurred, it is possible to check error types which are the first or second.

In step S1120, if an error is checked, checks whether the error is data corruption due to impact or not.

- 15 In step S1130, decide an extent of the impact by repeating the step of S1110 and S1120. The extent of the impact may be decided according to the value which is computed the frequent of data corruption due to the impact for a fixed time as an example. In step S1140, decides ESP mode according to the decision of impact extents.

- 20 The ESP mode may be set up automatically through the error checking operation of the reading step of recording medium.

Second method is that the ESP function mode is automatically set up in the player according to the value sensed automatically to the extent of impact using a separate sensor for sensing impact in the player. The frequency and

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strength sensed by the sensor for sensing impact is transmitted to control unit, and appropriate ESP mode is automatically applied to use that.

4. High-speed operation according to a decision of changing the recording medium

5 A digital audio data player reads and stores the information which is recorded to recording medium in memory for achieving the information of music stored the recording medium when the recording medium is loaded, as state above. Especially, the method that uses additional information related to audio data or a position in a recording medium of audio data previously to be a
10 database for searching stored information easily, in case of a recording medium stored the digital audio data which is compressed format. The information to be database is stored a memory within the player, and the storage is keeping in spite of power-off before recording new information because of using generally flash memory.

15 If the recording medium is loaded within the player, there is a high probability that the recording medium is same as the build up database within the player previously in case of return to power on. Accordingly, the present invention provides the player and method that is possible to booting and playing high-speed to check promptly whether the recording medium is changed or not,
20 when the state is changed to power on.

A checking method whether the recording medium is changed or not divides two. First method is checking mechanically, and second is checking by comparing basic information of the recording medium to read.

The first method of mechanical checking comprises variety methods.

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Most of all, the first method is monitoring whether a cover of an onloading unit in recording medium is open or not, or whether a recording medium is changed or not, not breaking the power of a control unit among the player in case of power off the player. Second method is installed the mechanical switch for

5 changing the state according to the cover switching or the changing of the recording medium, and checked the changing of the recording medium to read the state of switch before everything else when the power of the player is turn on.

Third method is installed a sensor for checking an opening of the cover or the changing of the recording medium, and then power off after recording a situation

10 for opening of the cover or changing of the recording medium to the memory in the state of power on.

Second method is checked whether a disc is changed or not to read only basic information of the recording medium. The basic information is a name of recording medium, total capacity of recording, and initiating time of recording,

15 etc., recorded to a disc information recording area 401 of Fig. 4 as an example. For retrieving and selecting the digital audio information recorded to recording medium, the others information is read and stored to be database in memory besides the basic information. For example, the others information is directory information recording area 402 and file information recording area 403 in Fig. 4.

20 But, when the power of the player turns on again, most of all, confirms only basic information of disc, and then the step of build up database is omitted in case that an loaded disc is same as previous disc already build up database for retrieving. So the time for deriving may be shortening.

Above two methods are used to more efficiency driving of the player by

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using together showing Fig. 12. That is, in step S1220, checks a changing of a disc in mechanical method. It is possible to directly playing without the step of reading disc information newly because the information recorded to memory of the player may be used as it is before power is turn on, in case of checking that there is no probability of disc changing in step of S1220. In step S1230, read basic information of disc in case that there is some possibility of disc changing in step of S1220. The next step of 1240 is check whether disc is changing or not compared the read information of disc with the information recorded to memory. It is for the case that the disc same as previous is loaded as it is or newly loaded when the cover is open or disc is loaded again after removing. Digital audio data may be played without the step of building up database, when disc information is checked same as the disc compared to the basic information stored to memory. In step of S1250, build up database to read basic information for searching, when disc information is different to the information stored to memory, because it means disc changing. And searching and playing is operated to use appropriate database.

5. Auto equalizer

The digital audio player of present invention is provided to an auto-equalizer function that is automatically applied a previously decided setting value of an equalizer according to an appropriate genre or information of sound to use genre or sound information within files stored digital audio information.

Digital audio files include field for recording file name, file attribute, additional information, etc. besides digital audio data for being played. The field may be recorded variety information related to digital audio data. Titles of

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music, artist, genre, lyrics, sound information, etc. are examples of the information. The genre information is indicated that the digital audio data is belonged a specific genre among variety like a Classic/ Rock/ Jazz as an example. The sound information is indicated to a sound state of digital audio data, for
5 example Live/ Club/ Theater/ 3D effect.

Most of advanced acoustic system is used an equalizer for correcting of tone quality. The equalizer provides the function for effective playing of acoustic to correct or remove the concentration of tones or noises in specific band.

A band distribution of tone is different to the genre or state of acoustic as
10 stated above. Accordingly, it is possible to set up an appropriate equalizer using the information related to equalizer, that is genre or acoustic information, of digital audio files in present player automatically.

As an example, the genre or acoustic information is stored to ID3 Tag area of an appropriate format in case of digital audio files stored the format
15 compressed MP3. Accordingly, an auto-equalizer function is embodied to playing the appropriate audio data after changing a setting value of equalizer automatically to read a genre or acoustic information of ID3 area in the files, before playing the appropriate digital audio file. Besides, it is possible to embody an auto-equalizer function in case of including the genre information
20 within file name, or the other file area for easy searching, not only tag area as stated above, by similar method.

6. Supporting multi-language

The multimedia player of present invention is supported multi-language display for everything character information of the Korean, English, Japanese,

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Unicode, etc., and supported a function for changing display language of menu according to the select of user. The player of present invention stores menu information comprised various languages to database, and provides the menu information desired the language according to user's select. And the function, that is displayed various languages at a stretch, is provided as needed.

Although the present invention has been described by way of exemplary embodiments, as stated above, it should be understood that those skilled in the art might make many changes and substitutions without departing from the spirit and the scope of the present invention which is defined only by the appended claims.

[INDUSTRIAL APPLICABILITY]

According to the present invention, the digital audio player that is possible to set up playing environments in passive mode by surrounding environments of impact, light and darkness, etc., whether the recording medium is changed or not, or playing information of genre to be played, or in automatic mode wherein an auto-adaptation is performed to sensing the playing environments is provided. So it is an advantage of using the player more easily and convenience. Besides, a power consumption of battery is reduced because only needed operation is performed by playing information.

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[CLAIMS]

1. Digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a decoding unit for generating digital audio signals to decode digital information signals
5 extracted from the recorded information; a digital analog converter for providing an output device of audio signal converting digital audio signals to analog signals; an input unit for inputting a predetermined command from a user; a displaying unit for displaying information regarded to the recording medium, digital audio data, or additional information; a memory for storing
10 the information regarded to the recording medium, digital audio data, additional information, or temporary generating information related thereof; and a control unit for controlling said each units,
wherein said control unit comprises a display control unit for changing a display format of said displaying unit according to surrounding
15 environments of said digital audio player.
2. Digital audio player as claimed in claim 1 further comprising a font memory stored at least one more font data displayed through said displaying unit, and wherein
20 said display control unit comprises a font control unit for controlling the font displayed through said displaying unit using the font data stored said font memory.
3. Digital audio player as claimed in claim 1 wherein said displaying unit

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comprises a backlight, and

said display control unit comprises a backlight control unit for
controlling said backlight.

5 4. Digital audio player as claimed in claim 1 further comprising a shading
sensor for sensing the exterior shade of said player,

wherein said display control unit comprises a sensor control unit for
controlling said shading sensor, and

controls said displaying unit to select a proper display format according
10 to the exterior shade of said player sensed by said shading sensor, and display
information.

5. Digital audio player as claimed in claim 1, wherein said display controls
unit comprises at least two display modes, and controls said displaying unit to
15 display information according to a display mode selected by user among said
display modes.

6. Digital audio player, which plays digital audio data to read from a
recording medium recorded digital audio files, wherein comprises a reading
20 unit for reading said recorded information from said recording medium; a
digital signal processing unit for extracting digital information from recording
information read by said reading unit, and processing in proper; a decoding
unit for generating digital audio signal to decode digital information signal; a
digital analog converter for providing an output device of audio signal

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converting digital audio signals to analog signals; a driving unit for driving
said recording medium or reading mean synchronized with the reading
operation of said recording medium to vary a reading location in said
recording medium; an input unit for inputting a predetermined command from
5 an user; a displaying unit for displaying information regarded to the recording
medium, digital audio data, or additional information; a memory for recording
the information regarded to the recording medium, digital audio data,
additional information, or temporary generating information related thereof;
and a control unit for controlling said each units,
10 wherein said control unit reading the digital audio data recorded to said
recording medium and recording to said memory, playing said digital audio
data to use said digital audio data recorded in said memory, controls said
reading unit to initiate the operation of reading when the amount of said digital
audio data recorded in said memory is under the standard value of a
15 predetermined reading initiation, and may change said standard value for
initiation of reading according to surrounding environments of said digital
audio player.

7. Digital audio player as claimed in claim 6 further comprising a
20 vibration sensor for sensing the vibration inflicted to said player,
wherein control unit controls said vibration sensor, and changes said
standard value for initiation of reading according to the extent of vibration
inflicted to said player which is sensed by said vibration sensor.

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8. Digital audio player as claimed in claim 6, wherein said control unit comprises at least two vibration modes and said standard value for initiation of reading corresponding said vibration modes, and changes said standard value for initiation of reading according to the vibration mode determined by the selection of user among said vibration modes.

9. Digital audio player as claimed in claim 6, wherein said control unit reading digital audio data recorded to said recording medium from said recording medium,

10 checking errors in said digital audio data before recording to said memory,

determining the extent of impact inflicted to said player by checking whether the detected error is corruption of digital audio data due to impact, and

15 changing said standard value for initiation of reading according to the extent of impact inflicted to said player.

10. Digital audio player, which plays digital audio data to read from a recording medium recorded plurality of digital audio files, wherein comprises

20 a memory for storing database being build to extract information related to said plurality of digital audio files with the view of readily retrieval of said plurality of digital audio files; and a control unit for controlling said player to retrieve and playing said digital audio files using said database stored said memory,

wherein said memory is nonvolatile memory that stored contents are

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keeping despite a power source is off, and

said control unit checks the recording medium loaded to said player

whether it is same to the previous played recording medium or not, and

operates retrieving and playing operation using database stored said memory

5 without the building operation of said database when said checking result is
same to the previous recording medium.

11. Digital audio player as claimed in claim 10, wherein said control unit
checks, whether the recording medium is same to the previous recording
10 medium or not, by mechanical method of using a sensor or switch.

12. Digital audio player as claimed in claim 10, wherein said control unit
checks, whether the recording medium is same to the previous recording
medium or not, by comparing said information stored in said memory with
15 reading basic information area of said recording medium loaded to said player.

13. Digital audio player as claimed in claim 10, wherein said control unit
performs the step of

(a) checking, whether the recording medium is same to the previous
20 recording medium or not, by using mechanical method of using a sensor or
switch;

(b) checking, whether the recording medium is same to the previous
recording medium or not, by comparing said information stored in said
memory with reading basic information area of the recording medium loaded

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to said player when said checking result of (a) step is different to the previous recording medium;

(c) operating a retrieving and playing operation using database stored said memory when said checking result of step (a) or step (b) is same to the
5 previous recording medium;

(d) controlling said player to retrieving and playing said digital audio files using said database stored said memory, after storing to said memory by extracting the information related to said plurality of digital audio files recorded to said recording medium and building database, when said checking
10 result of step (b) is different to the previous recording medium.

14. Digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a decoding unit for generating digital audio signals to decode digital information signals
15 extracted from the recorded information; a digital analog converter for providing an output device of audio signal converted digital audio signals to analog signals; an input unit for inputting a predetermined command from a user; a displaying unit for displaying an information regarded to the recording medium, digital audio data, or additional information; a memory for storing
20 the information regarded to the recording medium, digital audio data, additional information, or temporary generating information related thereof; and a control unit for controlling said each units,

wherein said output device of audio signal comprises

an equalizer for correcting a distortion appeared in amplification or

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transferring of signal, and

said control unit controls said output device of audio signal to output the audio signal in equalizer mode corresponded to that of extracted information related to equalizer of digital audio data included said digital audio files.

15. Digital audio player as claimed in claim 14, wherein said equalizer related information comprises information of genres or sounds.

10 16. Digital audio player as claimed in claim 14, wherein said equalizer related information is extracted from file name of said digital audio files.

17. Digital audio player as claimed in claim 14, wherein said equalizer related information is extracted from ID3 tag of said digital audio files when said digital audio files are MP3 format files.

18. Digital audio player, which plays digital audio data to read from a recording medium recorded digital audio files, wherein comprises a decoding unit for generating digital audio signals to decode digital information signals extracted from the recorded information; a digital analog converter for providing an output device of audio signal converting digital audio signals to analog signals; an input unit for inputting a predetermined command from a user; a displaying unit for displaying an information regarded to the recording medium, digital audio data, or additional information; a memory for recording

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the information regarded to the recording medium, digital audio data,
additional information, or temporary generating information related thereof;
and a control unit for controlling said each units,

5 further comprising a menu database having menu data consisted of at
least two languages, and

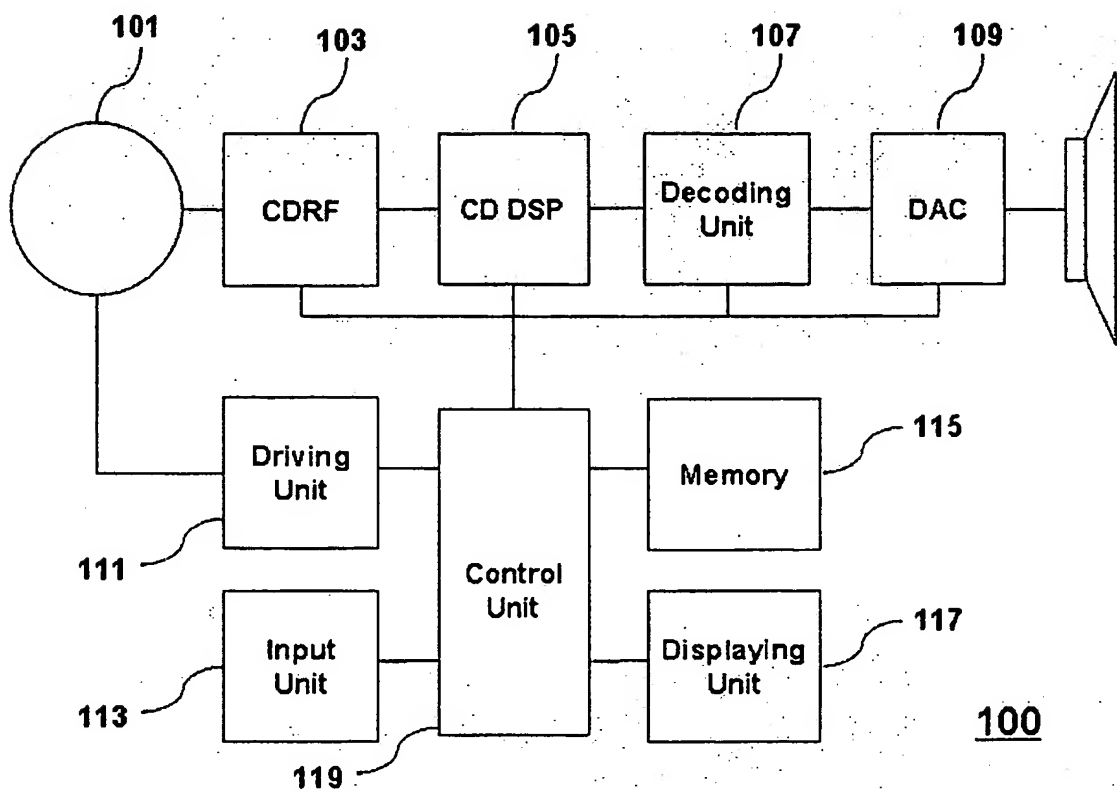
wherein said control unit controls said displaying unit to display the
information using said menu data consisted of the language determined by
user's selection among said menu database.

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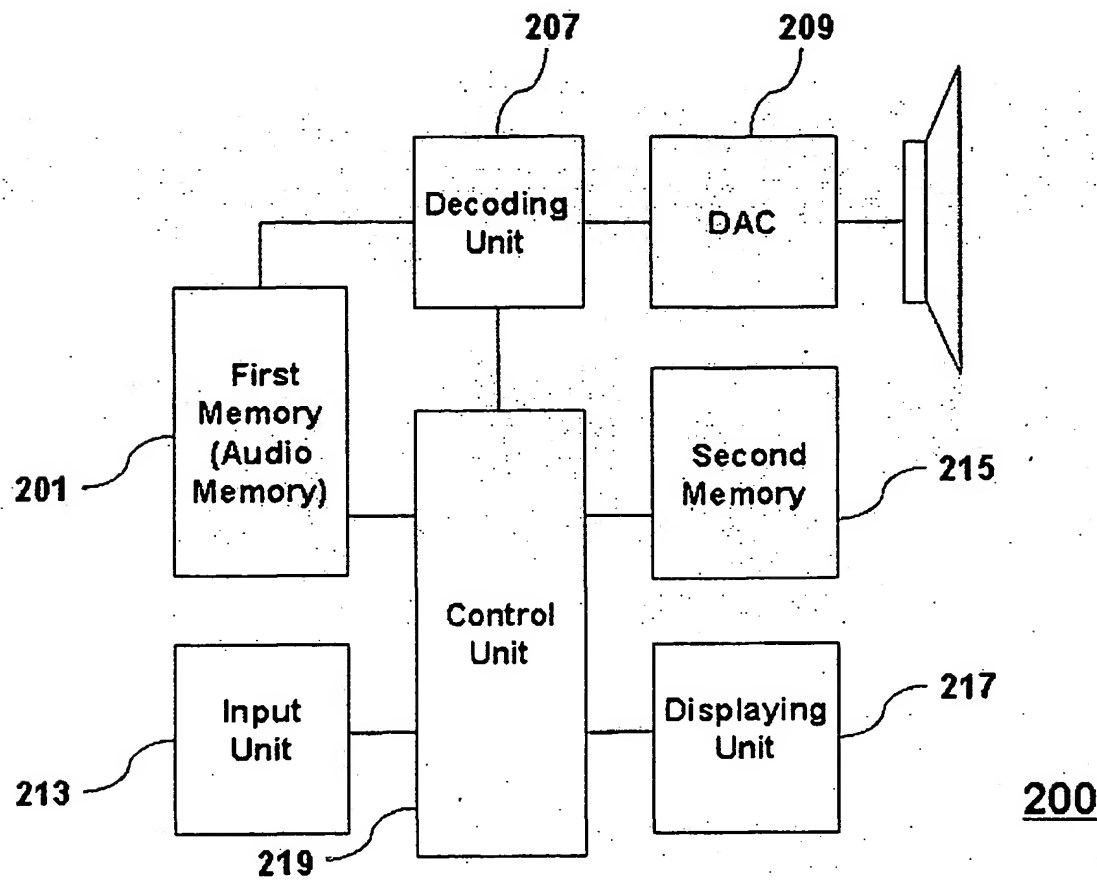
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【Drawings】

【Fig. 1】

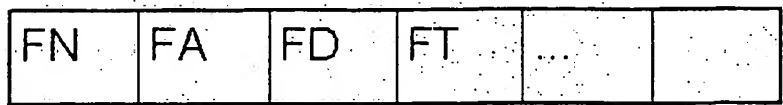


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[Fig. 2]



[Fig. 3]



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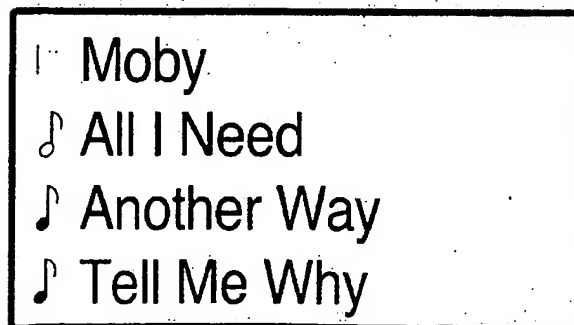
【Fig. 4】

401	Volume	Size	...		
403	DN	..	DN
405	FN	..	FN

【Fig. 5】



【Fig. 6】

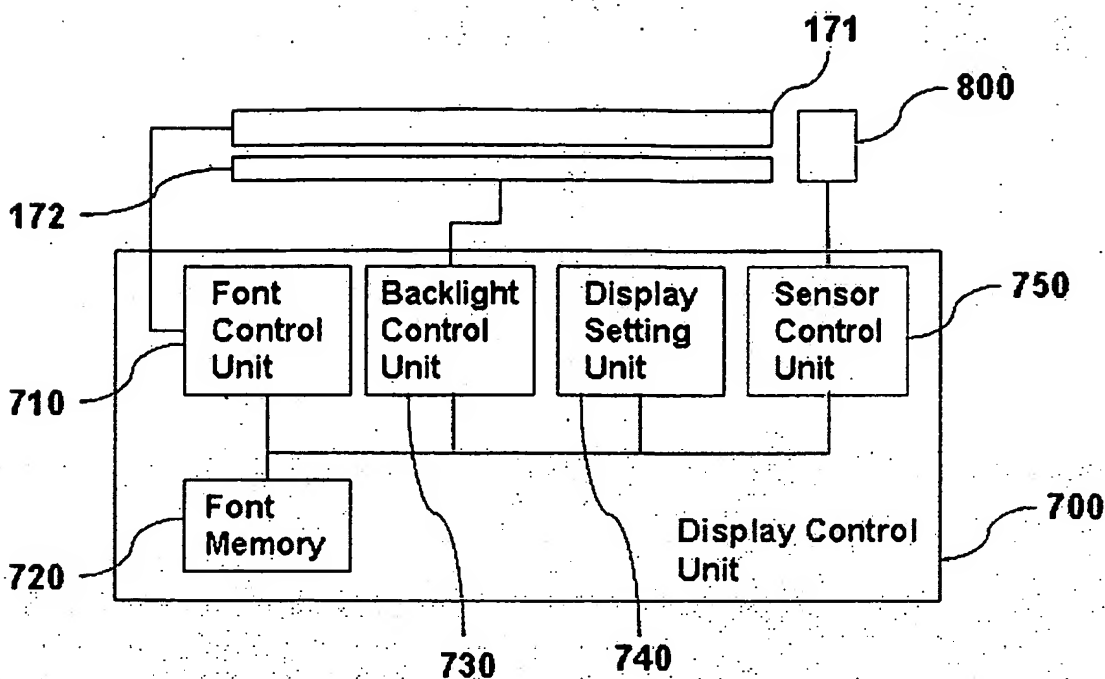


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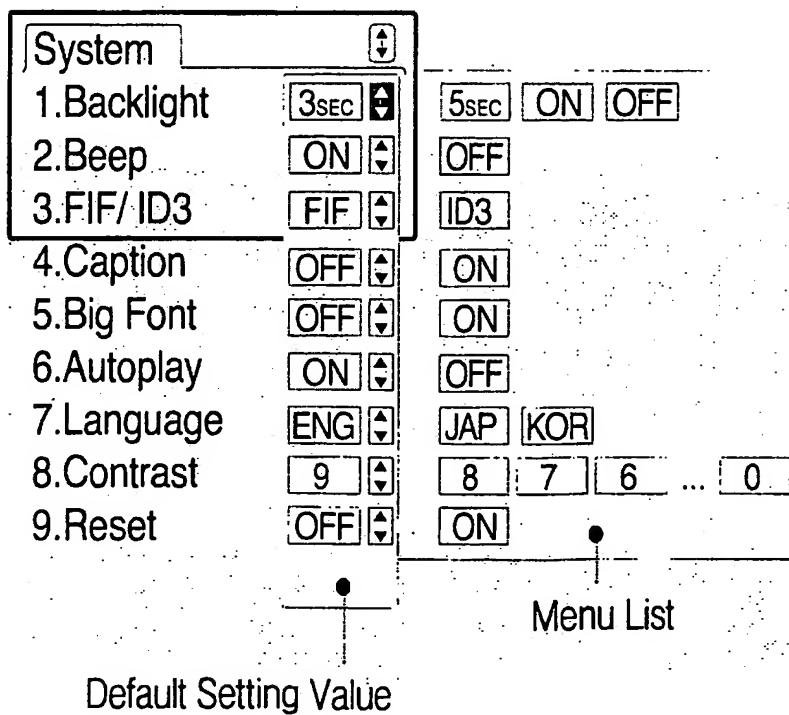
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[Fig. 7]



[Fig. 8]

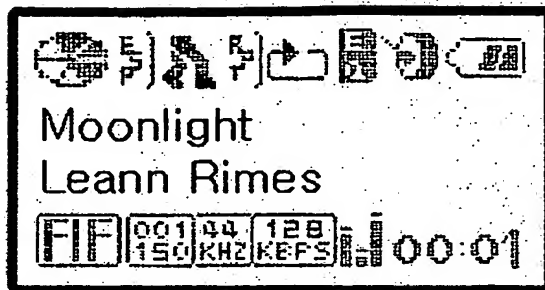


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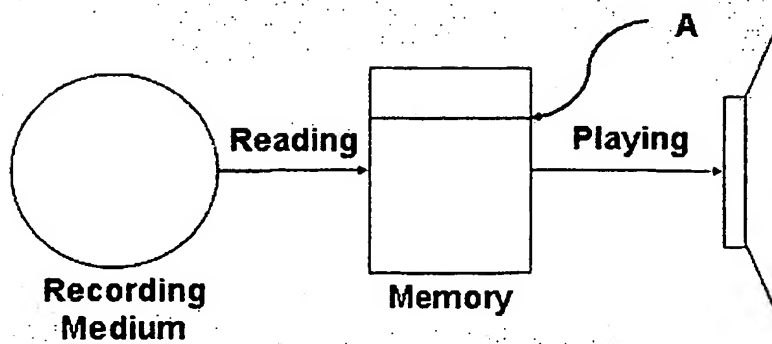
[Fig. 9a]



[Fig. 9b]



[Fig. 10]

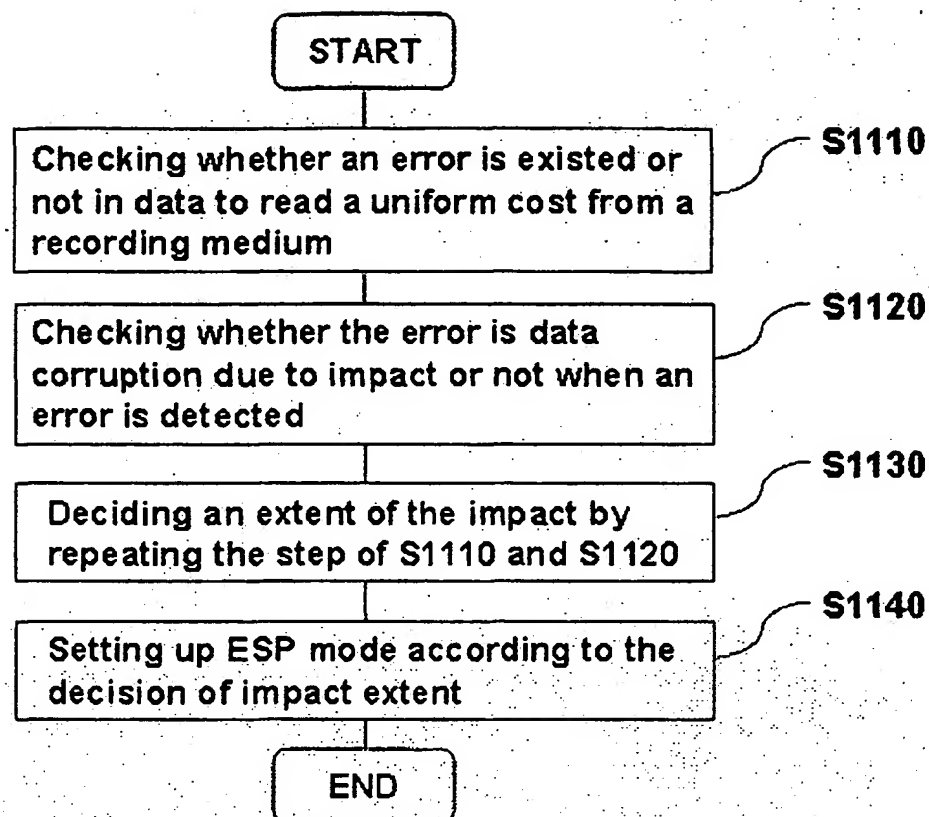


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[Fig. 11]



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[Fig. 12]

